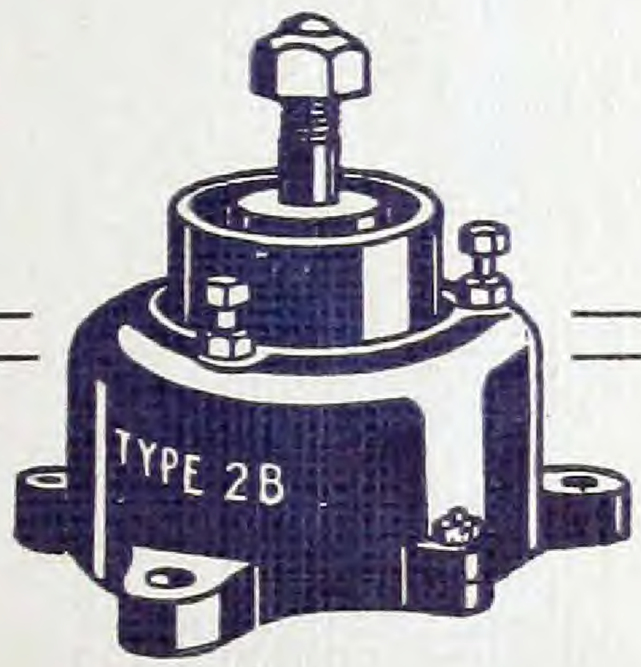
VIBRATION AND NOISE ELIMINATED



W. CHRISTIE & GREY, LTD.

4, Lloyd's Avenue, London,

E.C.3.

The Isolation of Vibration and Noise

OF INTEREST TO ALL
ENGINEERS, ARCHITECTS,
AND MACHINERY USERS

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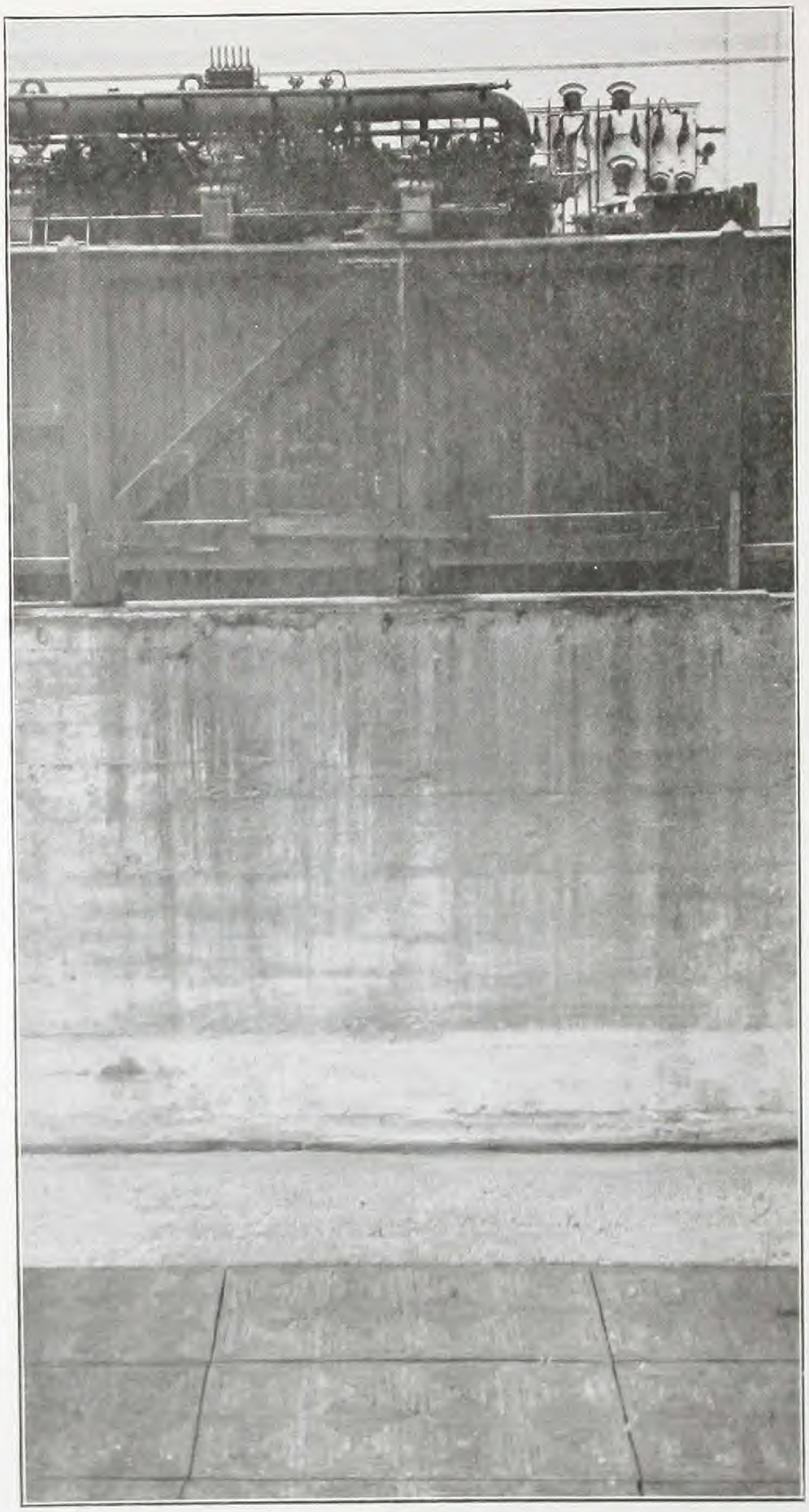


Main Foundation Block for Diesel Engine →

Lower Concrete Raft →

← Layer of **"Coresil"** under block.

← **"Coresil"** laid for another Diesel Engine Foundation at a lower level.

Unique photograph showing **"Coresil"** in position under existing foundation.

View of two Diesel Generating Sets upon a foundation isolated with our Patent **"Coresil"** Foundation Plates, in one of the generating stations of a Corporation which has extensively adopted isolated foundations of our design.

The excavation for the foundation of two additional sets will be noticed in the foreground, the photograph being taken when the **"Coresil"** for this further bed was being laid.

The Isolation of Vibration and Noise Caused by Machinery

PREVENTING the transmission of vibration and noise has become a problem of great importance, principally as a result of the increased speeds of modern machinery, coupled with the extensive use of power plant in present-day buildings. The majority of makers claim that their machines will run smoothly and noiselessly, but, despite this claim, probably every machine causes vibration perceptible to the human senses either as noise or simply as vibration. These vibrations frequently have adverse effects upon the building, and may affect the working of the machine itself. It is, however, as an annoyance that vibration and noise are most usually in evidence, and although generally the effects appear near the source, in some cases transmission occurs to comparatively long distances.

We have made an extensive study of problems arising from such causes, and our unique experience in this direction embraces machines ranging from the largest Diesel Engines to small Fans. Where trouble of this description is experienced or anticipated, we will be pleased at any time to submit our considered proposals.

Types of Vibration

When a machine is working, two classes of vibration are in evidence :—

First : **AIR VIBRATIONS** recognised as noise and divided into two classes :—

(a) **Primary Air Vibrations**—communicated directly from the machine to the surrounding air.

(b) **Secondary Air Vibrations**—created by the vibration of the foundation of the machine.

Second : **FOUNDATION VIBRATIONS ;** these, produced by the machine, are transmitted with high efficiency by the foundation, the floor, the adjoining walls and by the ground itself to

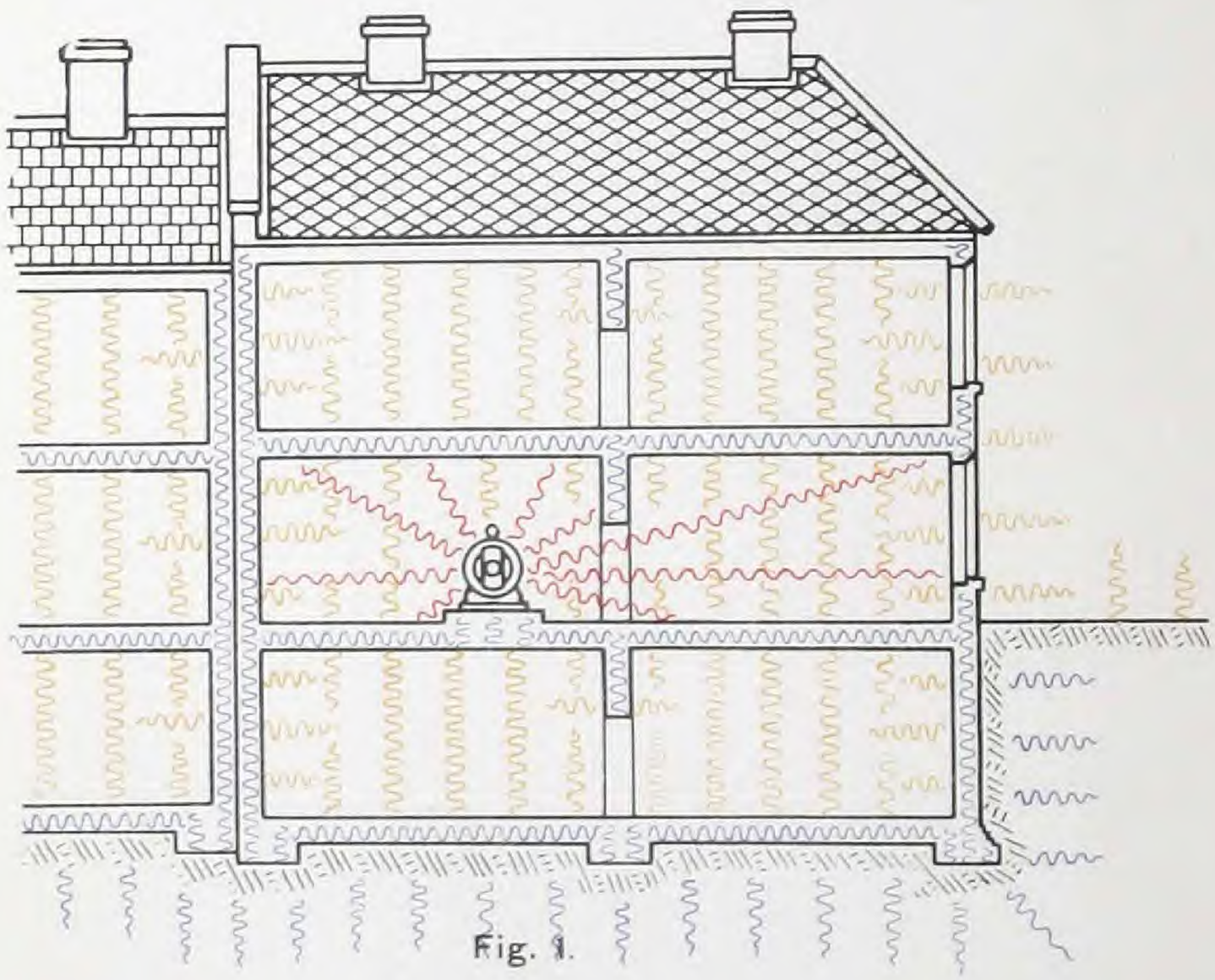


Fig. 1.

a considerable distance ; being either felt directly as vibration, or, by the creation of **Secondary Air Vibrations,** heard as noise.

When these **Secondary Air Vibrations** have the same periodicity as the **Primary Air Vibrations,** and therefore the same tone, they are often confused with the **Primary Air Vibrations,** and for this reason thought to be transmitted directly through the air from the machine.

Fig. No. 1 represents a section through a building showing the different types of vibrations transmitted from an electric motor as usually installed.

The Isolation of Vibration and Noise

The red lines indicate the **Primary Air Vibrations** which are only heard in the same room and through any opening such as a door, window or ventilator. An ordinary floor or wall rarely transmits these vibrations, their energy being usually insufficient to make the great mass of the walls and floor vibrate.

The Foundation Vibrations, indicated by the blue lines, are transmitted with high efficiency throughout the building and the surrounding area. These vibrations, even if not always directly perceptible, nevertheless affect the air in the room itself and that adjacent to the building, walls or ground, causing it to vibrate, thus creating the **Secondary Air Vibrations,** represented by the yellow lines, which are heard as a noise or hum.

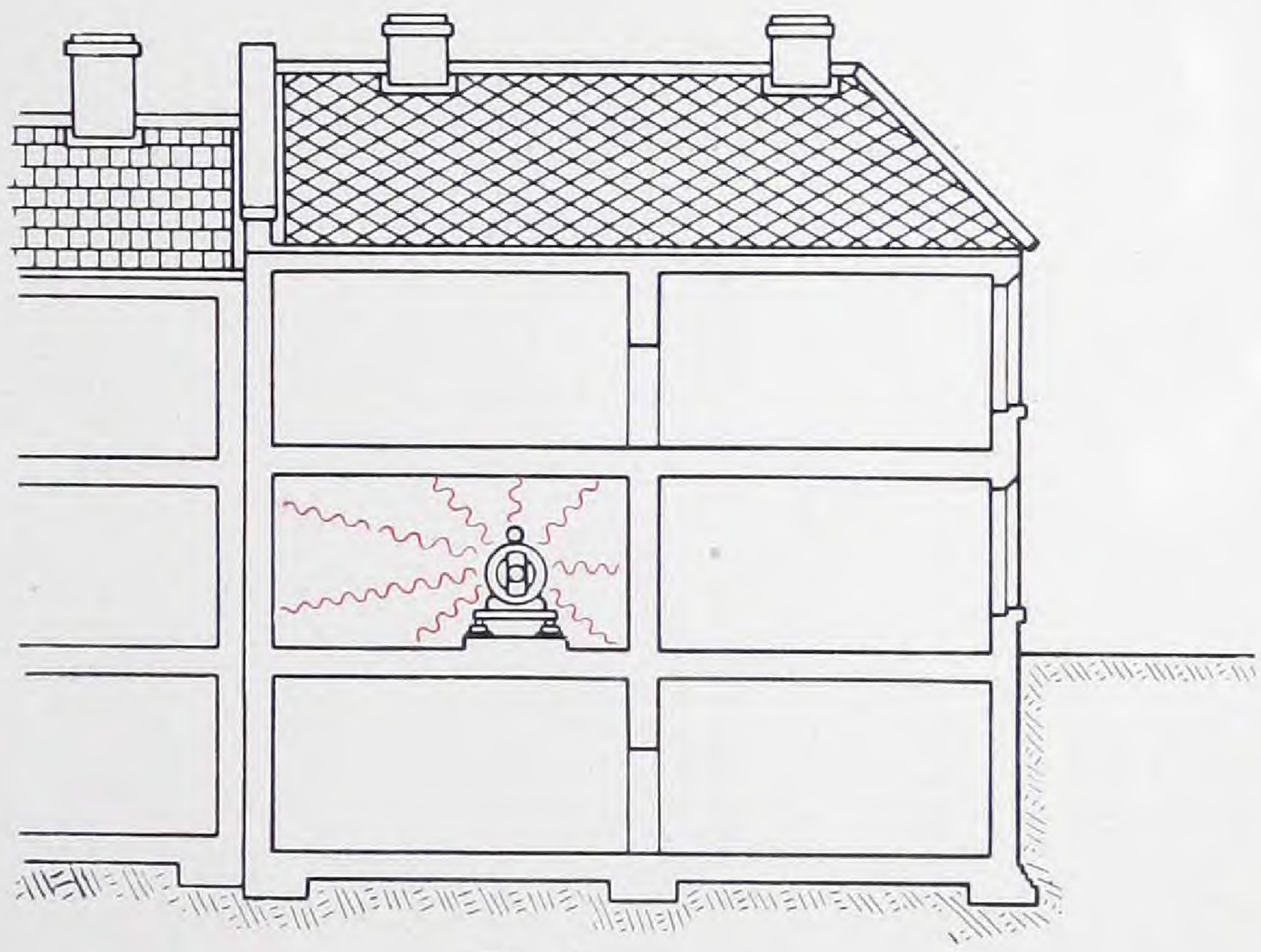


Fig. 2.

Fig. No. 2 illustrates the effect of isolating the machine from its bed by our system. The transmission of the **Foundation Vibrations** from the machine to its bed has been prevented, and the **Secondary Air Vibrations** thus eliminated. As a result, every room, with the exception of the one in which the machine is working, is free from noise.

By the elimination of the **Secondary Air Vibrations** the intensity of sound in the immediate vicinity of the machine has also been reduced, and if silence is required here, this can be effected by preventing the transmission of the **Primary Air Vibrations.**

Methods of Isolating Foundation Vibrations

Having now considered the types of vibration usually experienced, mention will be made of various methods of preventing the transmission of such vibrations.

In the majority of installations it is only required to prevent the transmission of vibration and noise from the engine or machine to other parts of the same building, or to other property. Under these conditions, the problem resolves itself to the adoption of some means of isolating the **Foundation Vibrations.**

The transmission of the **Foundation Vibrations** produced by the free energies or unbalanced forces of an engine or machine, may be prevented either by means of a specially-designed foundation, or alternatively, by entirely isolating the machine from its foundation or support.

SPECIAL FOUNDATIONS.

By combining the vibrating machine with a large mass or foundation, a certain amount of the free energy is absorbed, due to the resistance of the mass to movement, the intensity of the transmitted vibration being correspondingly reduced.

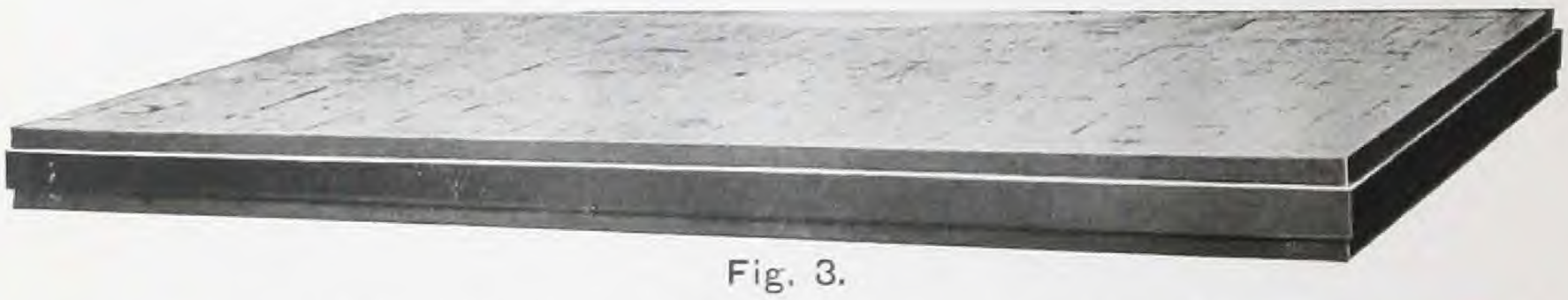


Fig. 3.

The transmission of the vibration which remains after energising the foundation can be prevented by keeping the sides of the foundation clear of the surrounding walls by an air space, and isolating the base of the foundation block with an elastic material. The elasticity or internal friction of the material absorbs the remainder of the redundant free energies of the machine, and, although the machine and its foundation will continue to vibrate, transmission of vibration to the surroundings has been eliminated.

Isolated foundations of this description have been in vogue for some years. In their design it is necessary to correctly distribute the foundation masses with regard to the free energies of the machine, and also to adopt efficient relations between the various factors.

For the purpose of isolating foundation blocks, various materials such as Felt, Peat, Granulated Cork, Rubber, etc., have been used with more or less unsatisfactory results owing to their rapid deterioration under the action of oil, water, etc., and in some cases by the consolidating of the material under load and vibration.

As a result of long experience in dealing with problems of vibration and noise, our **PATENT "CORESIL" FOUNDATION PLATES** have been designed to meet the many requirements of a material for use under an isolated foundation.

The Isolation of Vibration and Noise.

Patent "**Coresil**" Foundation Plates are a perfect medium for the absorption of vibration and noise.

They have a permanent resilience.

They are capable of sustaining a heavy load.

They are durable.

They will not deteriorate under the action of oil and water.

In the manufacture of "**Coresil**" see Fig. 3, specially selected and treated virgin cork is trimmed and cut into strips, which are carefully arranged in iron frames to take full advantage of the natural resilience of the cork. The plates are then impregnated with a preservative which maintains the resilience of the cork and absolutely prevents deterioration.

"**Coresil**" Plates are made up to a maximum size of 18 square feet each, and are of a uniform thickness of $2\frac{1}{2}$-in., although in exceptional cases this may be increased.

Fig. 4 shows the application of "**Coresil**" to an engine foundation. A lower slab or raft of concrete is laid, and upon this are placed the "**Coresil**" Plates side by side and end to end in accordance with the layout supplied with the material. Thin sheet felt, to seal the surface during the subsequent pouring of the main concrete block, is then laid over the plates and the required depth of concrete for the foundation built above. The sides of the foundation are, by means of an air space, kept entirely clear of the surroundings, although in cases where a belt drive is used the space in the direction of the drive may also be filled in with "**Coresil.**" The engine or machine is secured to the foundation in the ordinary way, the foundation bolts, however, must not pass through the "**Coresil.**"

As, owing to local conditions, each installation requires special consideration, we are pleased at all times to submit proposals for dealing with any particular machine, upon receipt of detailed drawings with the following particulars :—

Type of engine or machine.

Speed and horse-power.

Direction of belt drive (if any).

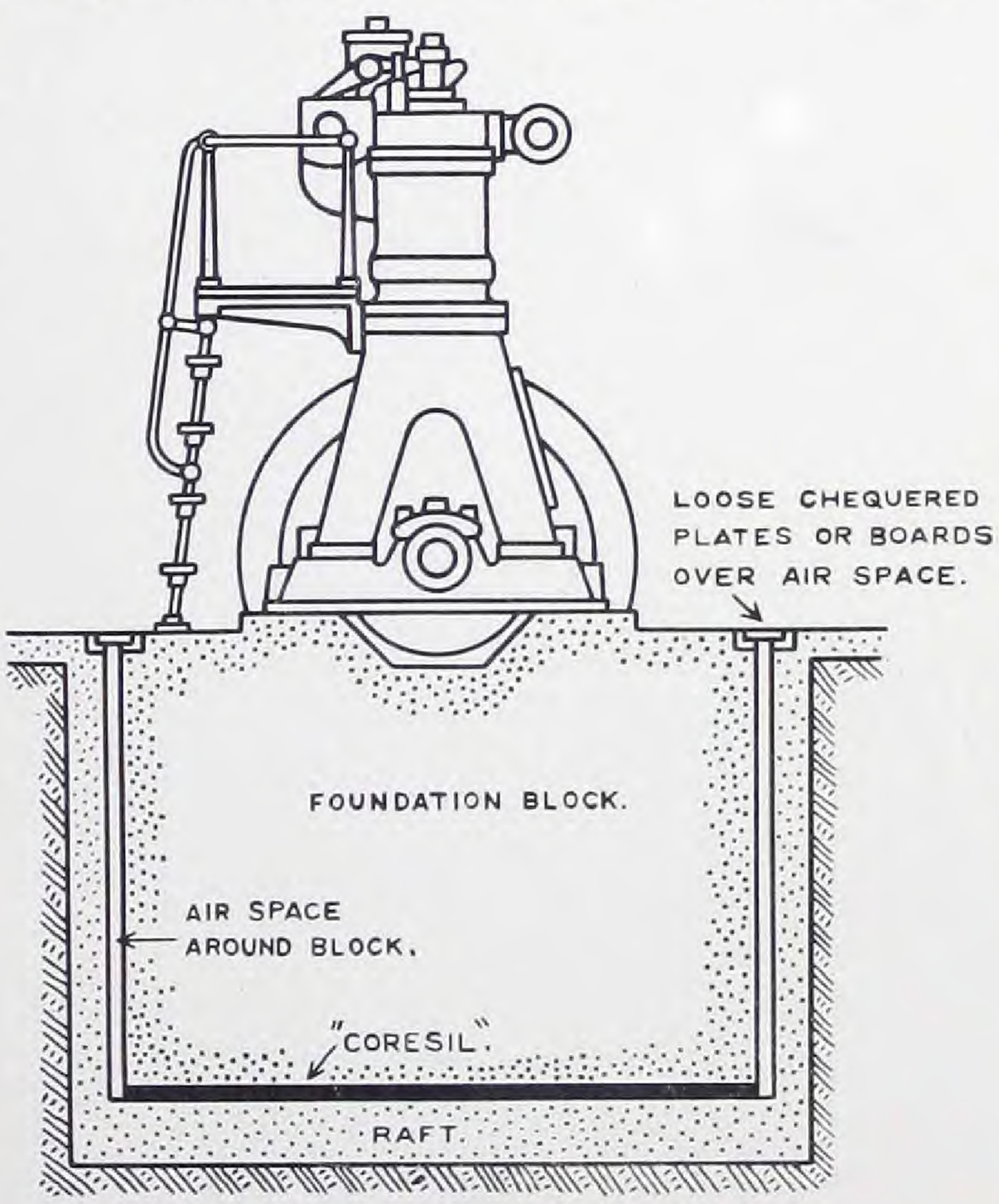
Plan of base of engine or machine.

Size of usual foundation.

Weights of engine or machine.

Position of foundation—whether on ground floor or upper storey.

Nature of subsoil under foundation.



ISOLATED ENGINE FOUNDATION.
FIG. 4.

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The Isolation of Machines from their Foundations or Supports

Frequently, it is inconvenient or impossible to adopt an isolated foundation ; for instance, in a restricted area, on the upper floor of a building, or on board a ship. Where such conditions exist, the machine can be isolated from its foundation or support by means of various methods and devices.

BY PADS OF RESILIENT MATERIAL.

We supply various descriptions of resilient pads which will absorb a certain amount of the vibration, and which will in many cases obtain a sufficient degree of isolation to meet with the requirements of the particular situation. We have frequently adopted such arrangements with satisfactory results, and in instances where our experience indicates that this method will give the amount of isolation required, we can submit a suitable quality of material, together with our suggestions for its installation.

Fig. 5.

Fig. 6.

BY PATENT ANTI-VIBRATORS.

The method of isolating machinery by means of pads directly under the machines is simple, but frequently far from effective, more especially when the machine has a reciprocating or concussive action, and also in cases where the annoyance is mainly a question of noise transmission.

Our Patent **Anti-Vibrators** have been specially designed to prevent the transmission of vibration and noise from machinery. They are self-contained units which are secured to the floor or support, the machine being firmly bolted to the **Anti-Vibrators,** whose internal arrangements are varied to suit the particular requirements of the installation.

These devices enable the employment of the damping effect of mechanical friction in addition to the internal friction of resilient material, and also provide means for adjustment under running conditions in order to obtain the most efficient loading and distribution of forces.

Two principal types are manufactured : the **PEDESTAL TYPE**, illustrated in Figs. 5, 6, and 7, and the **BRIDGE TYPE**, as shown in Figs. 8 and 9. Designs to suit special requirements, incorporating the features of the above types, are often put forward where the supporting arrangements can be simplified thereby.

The Pedestal Type of **Anti-Vibrator** is made in a range of sizes suitable for carrying loads of from $\frac{3}{4}$ cwt. to 5 tons on each **Anti-Vibrator.**

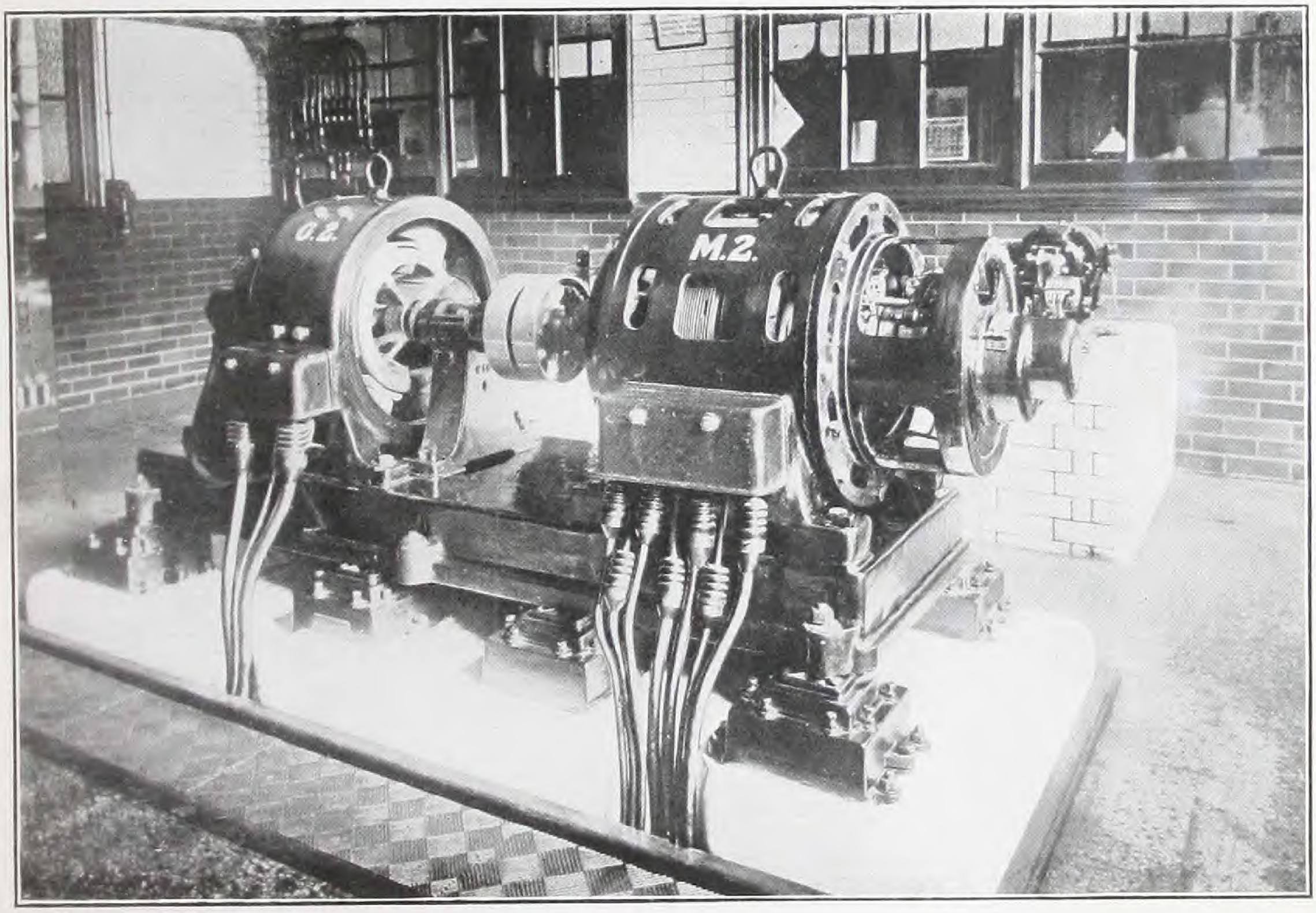

Fig. 7.

Fig. 7 shows a Motor Generator mounted upon eight Pattern 3A. Pedestal Type **Anti-Vibrators.** In this case, two machines were installed on the first floor of a ferro-concrete building where the vibration and noise from the machines, being transmitted throughout the building, seriously interfered with the business carried on. The mounting of the sets upon our Patent **Anti-Vibrators** completely eliminated the trouble.

Machines weighing from 3 cwts. to 4 tons may be accommodated upon Bridge Type **Anti-Vibrators,** which are specially suited for situations where, by reason of restricted headroom or other causes, it is undesirable that the machine be unduly raised.

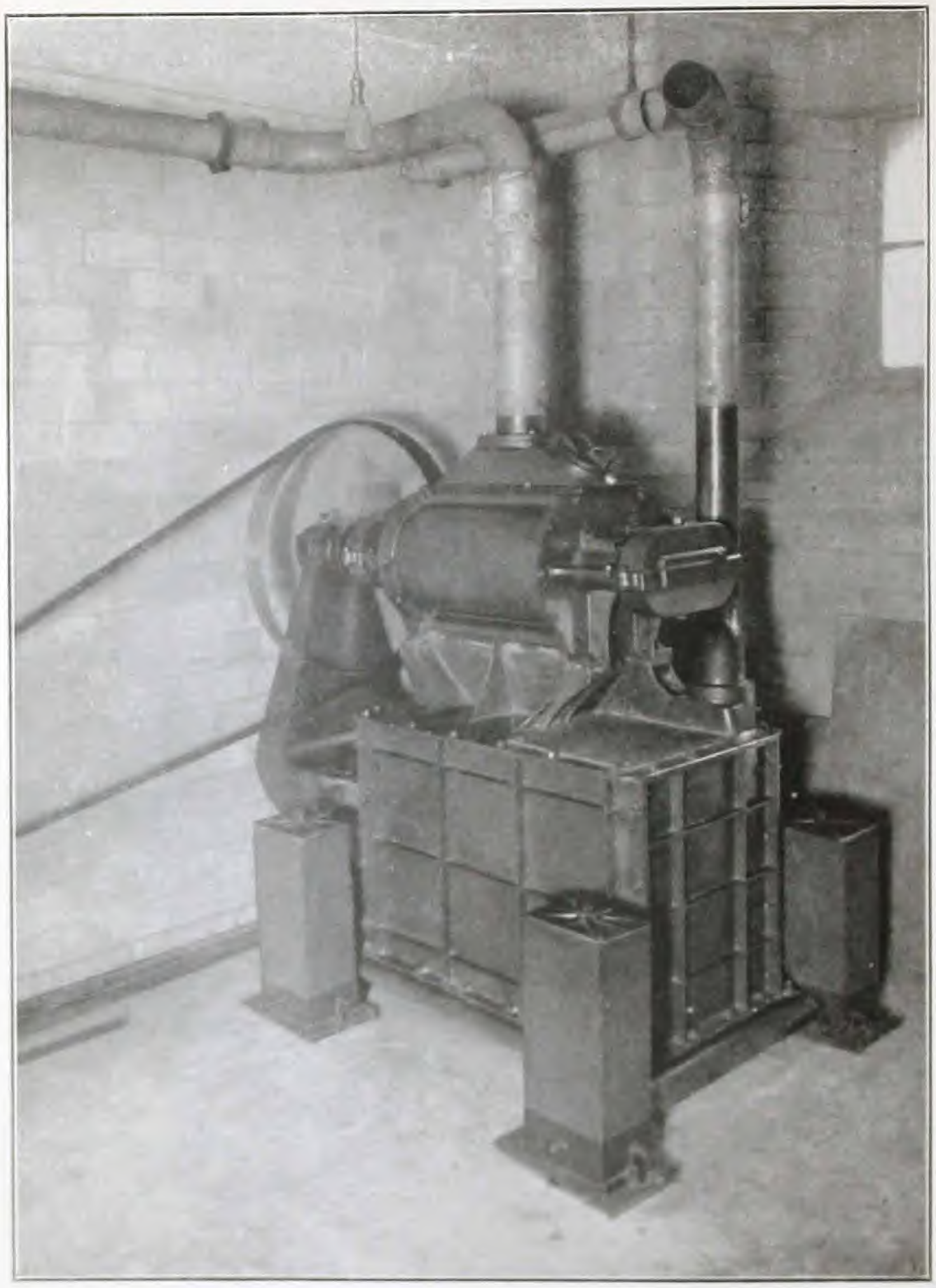

Fig. 8.

An example of the application of the Bridge Type of **Anti-Vibrator** is shown in Fig. 8. This Root's Blower is installed in the basement of a Scottish Library, and it will be noted that the metallic continuity of the inlet and outlet air ducts is broken to ensure that no transmission of vibration or noise shall occur by means of this piping.

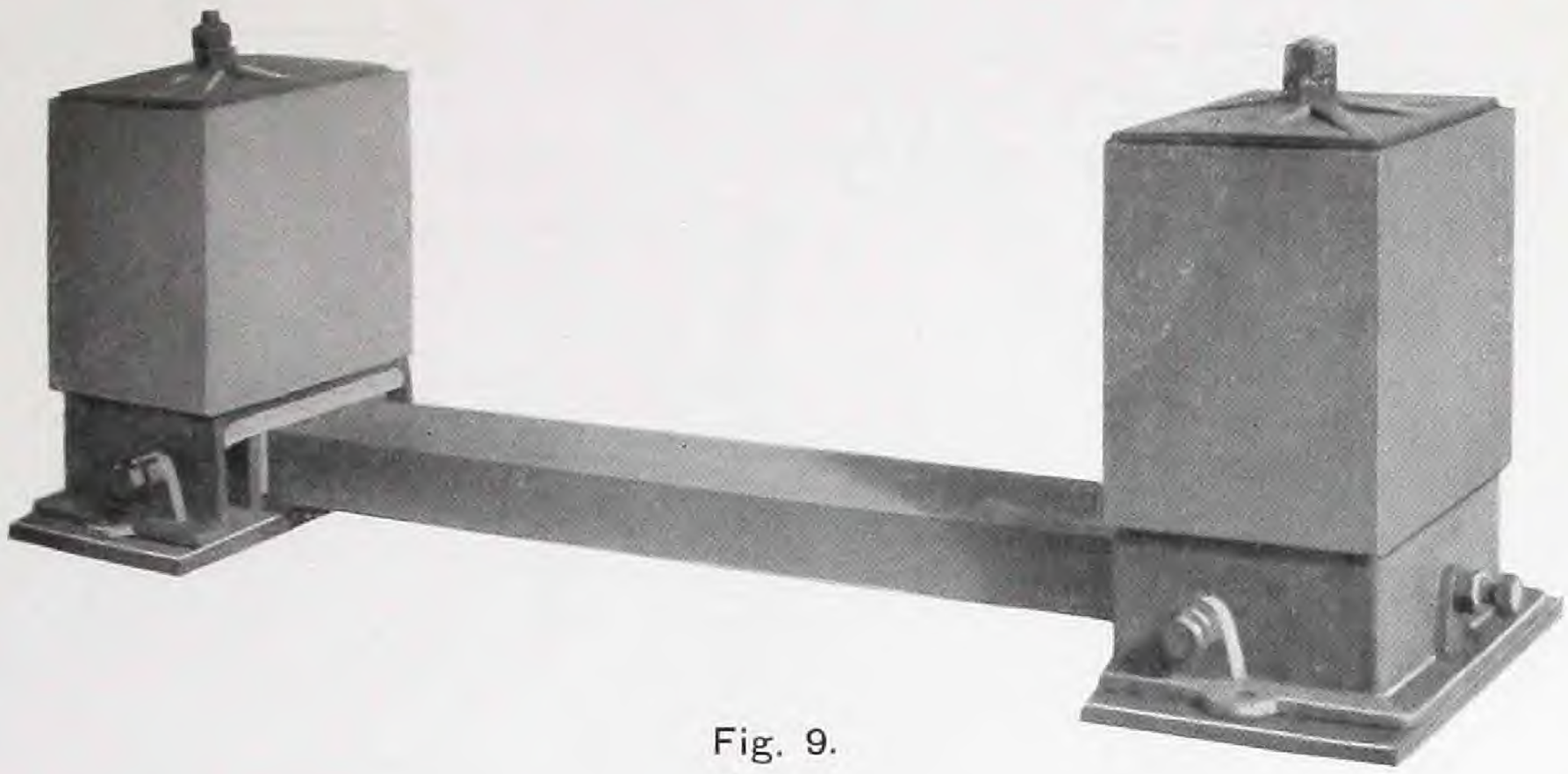

Fig. 9.

Bridge Type Anti-Vibrator.

Isolating Primary Air Vibrations

At times, silence is required adjacent to the machine, and to fulfil such conditions it is necessary that, in addition to the prevention of the transmission of **Foundation Vibrations,** the broadcasting of the **Primary Air Vibrations** shall also be prevented.

For this purpose the usual method is to encase the machine completely in a sound-proof box, such box being fixed to the now vibrationless floor or wall, and not in any way attached to the machine.

Sound-proof casings may be constructed of various materials, and local conditions are often the deciding factor when considering the most suitable design. We are always pleased to put forward recommendations for the construction of sound-proof cabinets or rooms where such are desired.

The Isolation of Vibration and Noise

It is impossible in a brief brochure of this description to touch upon more than the fringe of vibration and noise problems and their remedies. Usually, one of our standard materials or devices will satisfactorily overcome the trouble, but from time to time instances arise where special methods are necessary.

No "Cure-all" exists for any or all cases and it is necessary to consider each installation individually in order that the remedy which our experience indicates is the most suitable may be put forward.

The range of plant we have dealt with comprises machines of most varied characteristics, as the list below will indicate.

Diesel Engines.
Gas and Oil Engines.
Steam Engines.
Turbo Generators.
Dynamos.
Electric Motors.
Rotary Converters.
Motor Generators.
Static Transformers.
Woodworking Machinery.
Printing Presses.
Linotype and Monotype Machines.
Steam Hammers.
Pneumatic Hammers.
Power Presses.
Foot Presses.
Stampers.
Roller Crushing Mills.
Grinding Mills.
Soap-making Machinery.
Circular Saws.
Elevators.
Refrigerators.
Ventilating and Exhausting Fans.
Blowers.
Air Compressors.
Tram Cars.
Underground Electric Carriages.
Rail Tracks.
Etc., etc., etc.


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